GENETIC ENGINEERING AND HUMAN HEALTH

Engineering Health

Genetic engineering techniques allow us to work with genes to get the traits we want. Since DNA is present in nearly all living things, we can work with a plant's existing "gene library," (cisgenics) or get genes from somewhere else (transgenics) to improve our foods and even make medicines. Transgenic techniques are much harder, so they're used when the goal can't easily be achieved any other way.

HEALTHY AND NUTRITIOUS

Genetic engineering allows us to create crops such as bananas and rice with beta carotene, which our bodies convert into vitamin A. Farmers will soon be able to grow these crops to help alleviate malnutrition. We can also work with other organisms such as bacteria and yeast, engineering them to make medicines and other valuable products.

You **can** get from there to here.

Some crops like rice are grown and eaten widely, but they mostly offer "empty calories" – lots of energy, but few nutrients. Likewise, some medicines are difficult or too expensive to make in the lab. Genetic engineering allows us to harness natural systems to produce crops with enhanced nutrition and to produce medicines that would not otherwise be possible.

! Before genetic engineering, people living with diabetes had to rely on insulin from slaughtered pigs to stay alive. It worked, but animal insulin is not quite the same as the human form and it could cause problems such as allergic reactions. Since 1982, insulin has been manufactured using bacteria engineered with human genes using a technique called recombinant DNA.

MEDICINES AND VITAMINS

In Uganda, bananas are a staple food, much like bread in North America. Many different varieties are grown, including the most popular: the East African Highland cooking banana. While it's a great source of starch and calories, it has little beta carotene (the stuff that makes carrots orange), which your body turns into vitamin A. Children that don't get enough vitamin A suffer blindness, sickness and even death due to stunted growth and weakened immune systems.

Government scientists in Uganda and Australia moved genes from a banana variety high in beta carotene into the Cavendish banana (the ones on your kitchen counter) to produce a "golden banana." The next step is to try it with the East African Highland variety. If all goes well, farmers could be growing these bananas by 2021.


Banana

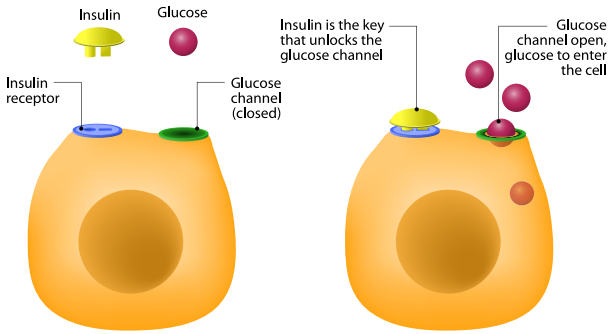
POWER TO THE PEOPLE

Harnessing microbes through genetic engineering allows us to make medicines quickly and in quantity, helping to make them more affordable and available.

In the same way, fortifying the crops that people eat regularly allows them to grow their own vitamins rather than rely on donations of supplements.

Insulin injection

HOW DOES INSULIN WORK?



The genetic engineer's toolbox

To harness organisms such as bacteria and yeasts to make medicines, scientists add genes using what are called recombinant DNA techniques. For example, to make human insulin, they first isolated the human genes responsible for insulin production. Using some elegant chemistry, they move the genes into bacteria.

From there, it's a matter of keeping the bacteria well-fed and happy in fermenters while they multiply and produce insulin. This technique is also used to make vaccines for diseases such as influenza, hepatitis B and human papilloma virus.

IS IT SAFE?

Like any new vaccine or medicine, those produced using genetic engineering are tested thoroughly for efficacy (that is, to make sure they actually work) and for safety and reviewed by Health Canada. Since only a few genes are being moved and their function is known, there's little chance of making something unexpected. The focus is on the end product, not the process used to make it.

While genetic engineering makes a lot of new things possible, it still takes a lot of work, expertise and time. It can be years – even decades – before an idea results in a product, passes through many rounds of rigorous testing, and finally makes it into a doctor's hands or pharmacist's shelf.

Pharmacist Shelf